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BULLETIN No. 16-71

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

October 1, 1970 - September 30, 1971

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JUNE 1972

NORMAN B. LIVERMORE, JR.
Secretary for Resources
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RONALD REAGAN
Governor
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WILLIAM R. GIANELLI
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DEPARTMENT OF WATER RESOURCES

RONALD REAGAN, Governor, State of California
WILLIAM R. GIANELLI, Director, Department of Water Resources
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DIVISION OF RESOURCES DEVELOPMENT

Herbert W. Greydanus . . . . . Division Engineer

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ABSTRACT

Within the reporting period, October 1, 1970, through September 30, 1971, nine licensees conducted weather modification projects in ten locations in California. Except for two programs for fog suppression for which polyelectrolytes, surfactants, and urea were used, all programs in which seeding did take place dispersed some form of silver iodide as the active ingredient. Warm fog suppression experiments were conducted by the U. S. Air Force and the U. S. Navy.

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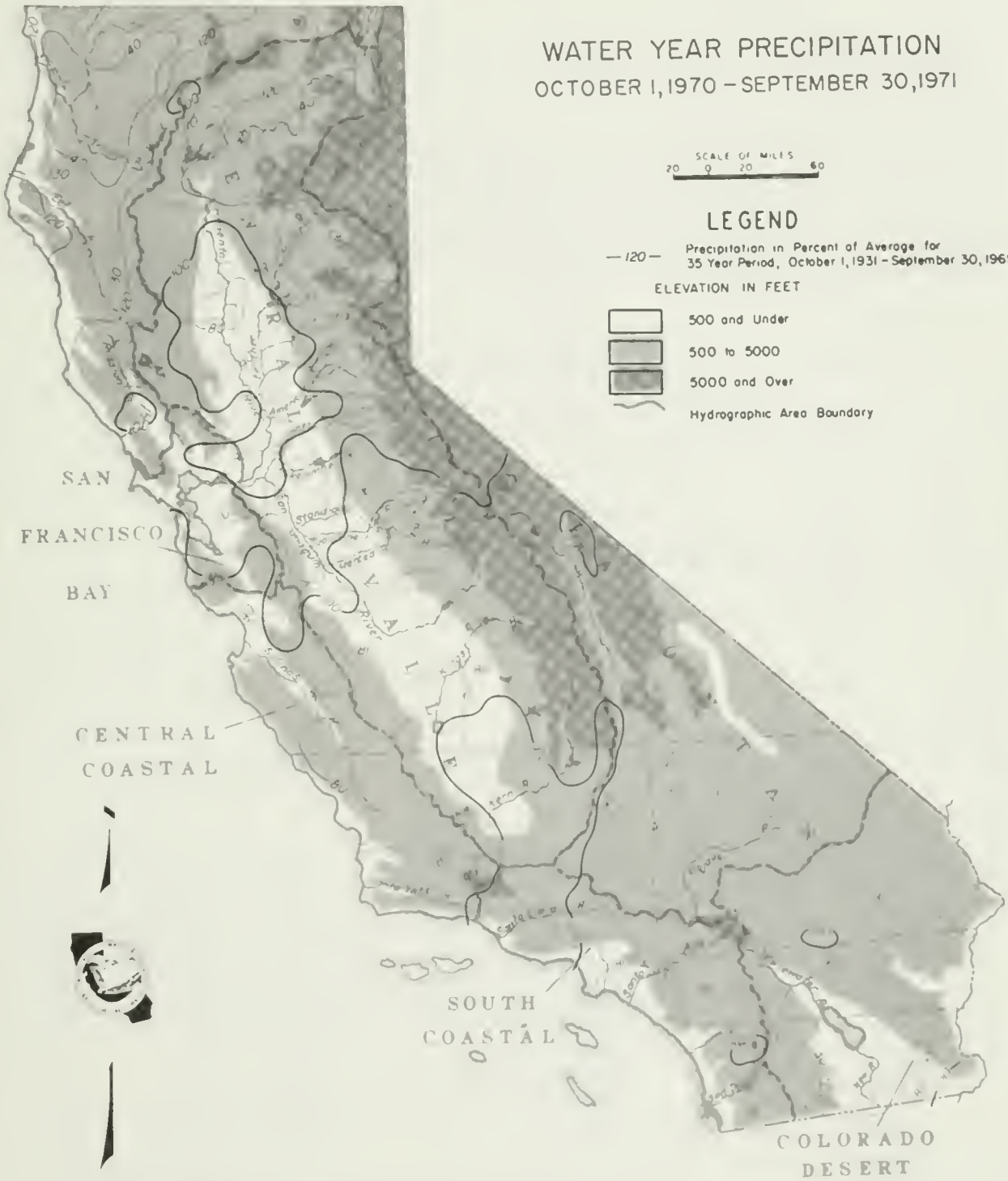


NOTE: Bulletin No. 120-71 "Water Conditions in California Fall Report", Dated October 1971, Provides Detailed Precipitation Data For The 1970-71 Water Year

WEATHER MODIFICATION OPERATIONS

Weather modification operations were conducted in ten areas of the state during the 1970-71 water year by nine licensed operators. Two of these projects were operated to suppress fog: the active agents in one case were polyelectrolytes and surfactants and, in another, urea powder was dispersed. The remaining projects used silver iodide in various forms as the active agent to increase precipitation.

Silver iodide has been listed nominally as the active agent whenever it was part of the dispersed material. However, when a solution of silver iodide and sodium iodide in acetone was burned, the active agent has been considered to have probably been a complex salt of silver iodide and sodium iodide.

Three projects reported in previous years were inoperative during the 1970-71 water year. The Santa Clara County Flood Control and Water District project was inactive for its second season. The Lake Almanor Project of the Pacific Gas and Electric Company, which functioned during the preceding season, was also inactive. Definite plans exist to reactivate both projects in the 1971-72 water year. The Upper Santa Ana River Project of the San Bernardino Valley Municipal Water District was active during the 1970-71 water year but no seeding occurred.

Fog suppression experiments were performed at Arcata, California, by the U. S. Naval Weapons Center of China Lake, California, and the U. S. Air Force at McClellan Air Force Base, California. These two activities are described separately from those performed by licensed operators.

Project 1-71-1: UPPER SAN JOAQUIN RIVER BASIN

SUMMARY

Licensee: North American Weather Consultants

Client: Southern California Edison Company

Target Area: Drainage area of Upper San Joaquin River and tributary streams above Southern California Edison Power House No. 3

Purpose: To increase snowpack in the drainage area of the river

Active Agent: Silver iodide

Dispersal Method: Ground-based generators using silver iodide and sodium iodide (in acetone) in generators Nos. 2, 3, 4, 5, 6, and 7, and silver iodide and ammonium iodide (in acetone) in generators Nos. 1, 8, 9, 10, 11, and 12

Generator No.	Generator Location	Elevation	Hours of Operation* Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	Total
1	Florence	7,450	4:00	51:45	55:45	0	16:15	17:00	24:15	39:00	208:00
2	Vermilion	7,475	13:15	66:15	24:00	16:00	16:15	17:00	24:15	39:00	216:00
3	China Peak	8,600	0	40:00	14:15	0	0	0	24:15	28:45	107:15
4	Mt. Given	9,760	13:15	85:45	149:30	16:00	16:15	17:00	24:15	39:00	361:00
5	Huntington	7,000	13:15	85:45	149:30	16:00	16:15	17:00	24:15	26:30	348:30
6	Mammoth Pool	3,200	7:30	24:30	108:15	16:00	16:15	17:00	20:45	28:15	238:30
7	Shaver	5,400	5:45	85:45	125:15	12:30	0	17:00	24:15	24:30	295:00
8	Pine Ridge	4,080	0	35:30	27:15	0	0	4:45	0	0	67:30
9	Auberry	2,080	0	42:00	23:45	0	0	5:15	0	0	71:00
10	Toll House	1,920	0	10:30	18:30	0	0	0	0	0	29:00
11	South Fork	2,640	0	42:00	33:15	0	0	17:00	2:00	0	94:15
12	Bass Lake	3,000	0	23:30	32:00	0	0	16:30	3:00	0	75:00
	Total hours		57:00	593:15	761:15	76:30	81:15	145:30	171:15	225:00	2,111:00
	Number of storms		2	4	6	1	1	1	3	4	22
	Days of seeding		2	7	12	1	2	2	3	5	34
	AgI used (grams)		342.0	3,559.5	4,567.5	459.0	487.5	873.0	1,027.5	1,350.0	12,666.0
	Rate of dispersal (grams of of AgI per hour per generator)		6								

* To nearest quarter hour.

Project 1-71-2: SANTA BARBARA COUNTY

SUMMARY

Licensee: North American Weather Consultants

Client: Naval Weapons Center, China Lake

Target Area: Santa Barbara County

Purpose: To test operations which may modify natural precipitation

Active Agent: Silver iodide

Dispersal Method: Ground-based pyrotechnics (LW-83 fusees) and Lohse aircraft generator burning a solution of silver iodide and ammonium iodide (in acetone)

Generator		Hours of Operation*						Total
Location	Elevation	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	
El Capitan Lodge	3,500	5:00	3:15	0	1:15	2:45	2:00	14:15
Aircraft		0	1:25	0:55	0	0	0	2:20
Total		5:00	4:40	0:55	1:15	2:45	2:00	16:35
Number of fusees used		25	18	0	6	12	8	69
Rate of dispersal (grams of AgI per fuse)		400	400	-	400	400	400	-
Length of burn per fuse (minutes)		3.2	3.2	-	3.2	3.2	3.2	
Rate of dispersal (generator, grams of AgI per minute)		-	14.4	14.4	-	-	-	-
AgI used (grams)		10,000	8,424	792	2,400	4,800	3,200	29,616
Number of storms		2	4	1	1	1	2	11
Days of seeding		4	4	1	1	1	2	13
Number of flights		0	1	1	0	0	0	2

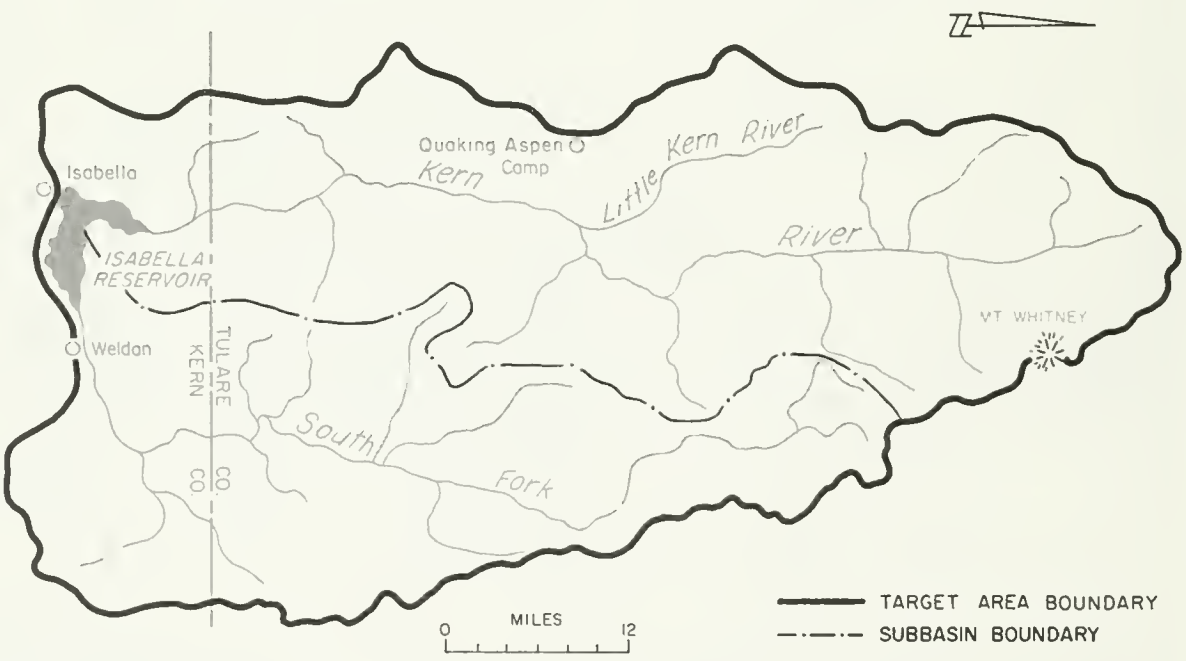
* To nearest five minutes.

Project 12-71-1: UPPER KERN RIVER BASIN

SUMMARY

Licensee:	Precipitation Control Company of California
Client:	Kern County Board of Supervisors
Target Area:	Kern River watershed
Purpose:	To increase precipitation and streamflow
Active Agent:	Silver iodide
Dispersal Method:	Silver iodide introduced into an electric arc to produce smoke

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
Hours of flight time	10:10	16:05	12:55	16:25	11:25	4:00	71:00
Number of days on which operated	4	5	2	6	4	1	22
Number of flights	4	8	4	8	4	1	29
AgI used (grams)	432	684	549	698	485	170	3,018
Rate of dispersal per hour	$1\frac{1}{2}$ ounces (42.5 grams)						



Project 18-71-1: SAN GABRIEL MOUNTAINS

SUMMARY

Licensee: Los Angeles County Flood Control District

Client: Same

Target Area: Southern slopes of the San Gabriel Mountains in the San Gabriel River, Big Tunjunga Creek, and Pacoima Creek drainage basins tributary to the district's reservoirs

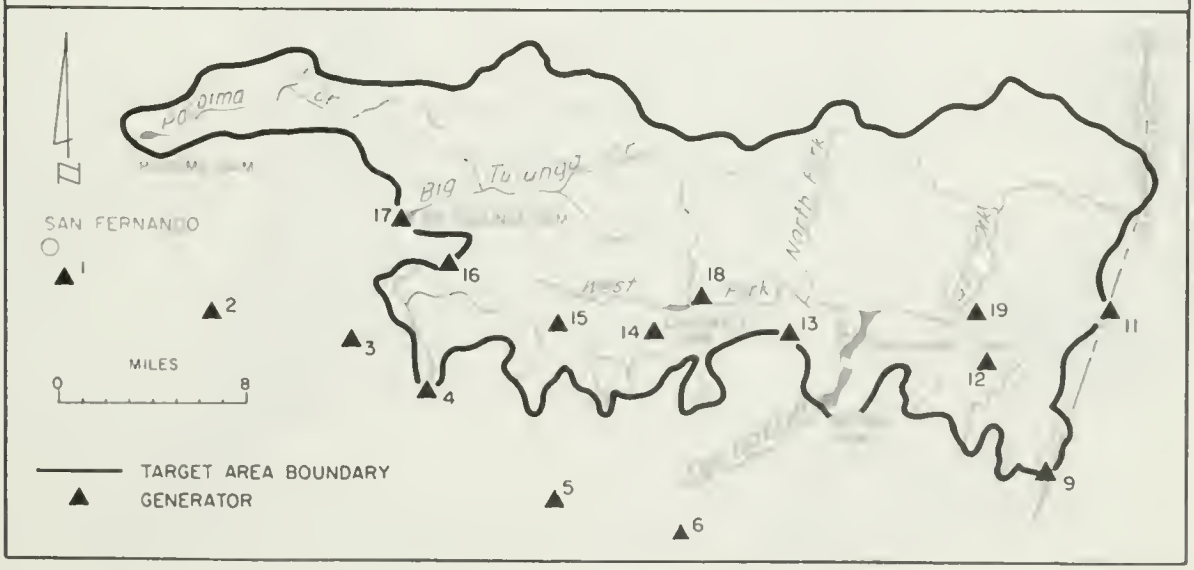
Purpose: Water supply increase

Active Agent: Silver iodide

Dispersal Method: Ground-based generators using a 2% solution of silver iodide and ammonion iodide in acetone solution, producing 10^{12} to 10^{13} nuclei per second (10^{14} to 10^{16} nuclei per gram AgI)

Generator			Hours of Operation*							Total
No.	Location	Elevation	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
1	Pacoima Spreading Grounds	930	0	0	0	0	0	0	0	0
2	La Tuna Debris Basin	1,160	0	0	0	0	0	0	0	0
3	Pickens Patrol Station	1,600	17:15	10:00	0	0	0	0	0	27:15
4	Devil's Gate Dam	1,090	16:15	9:45	0	0	0	0	0	26:00
5	Eaton Spreading Basin	540	0	0	0	0	0	0	0	0
6	Longden Yard	356	0	0	0	0	0	0	0	0
9	Thompson Creek Dam	1,800	0	0	0	0	0	0	0	0
11	Mt. Baldy Guard Station	4,275	0	0	0	6:45	0	0	0	6:45
12	Tanbark Flats	2,750	0	0	0	4:00	4:00	1:45	0	9:45
13	Pine Mountain	4,100	0	0	0	0	0	0	0	0
14	Spring Camp	4,655	0	0	0	15:00	0	2:00	18:15	35:15
15	Mt. Wilson	5,709	0	0	0	15:15	6:00	1:30	18:30	41:15
16	Red Box Ranger Station	4,625	18:15	1:45	0	16:00	5:30	0	18:45	60:15
17	Big Tujunga Dam	2,315	17:00	13:30	0	0	6:00	0	18:30	55:00
18	Cogswell Dam	2,300	0	0	0	15:15	4:00	1:45	18:00	39:00
19	San Gabriel Canyon, East Fork Ranger Station	2,075	0	0	0	0	0	0	0	0
	Total		68:45	35:00	0	72:15	25:30	7:00	92:00	300:30
Number of storms			1	3	0	1	1	1	1	8
Days of seeding			2	4	0	2	1	1	2	12
AgI used (grams)			412.5	210.0	0	433.5	153.0	42.0	522.0	1,803.0
Rate of dispersal (grams of AgI per hour per generator)			6							

*To nearest quarter hour.



Project 21-71-1: UPPER KINGS RIVER BASIN

SUMMARY

Licensee: Atmospherics Incorporated

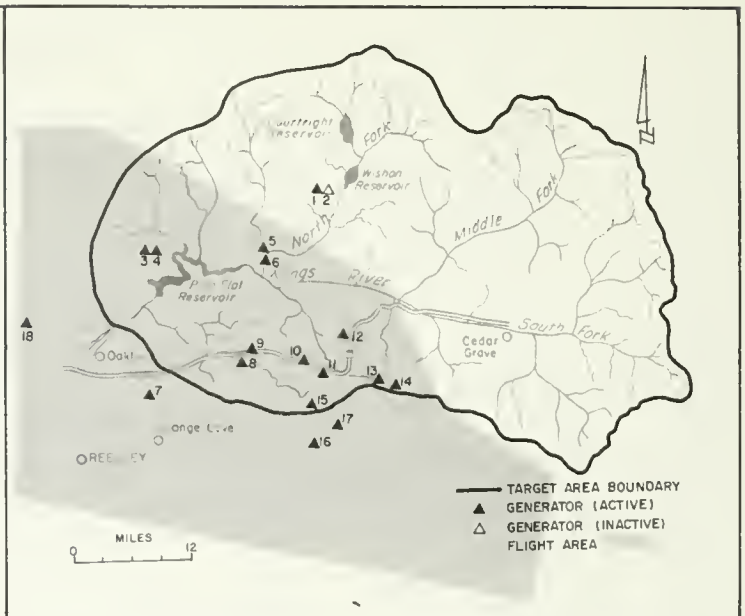
Client: Kings River Conservation District

Target Area: Upper Kings River Basin

Purpose: To increase precipitation

Active Agent: Silver iodide

Dispersal Method: Ground-based generators burning a solution of silver iodide and ammonium iodide or sodium iodide in acetone. After December, the only solution used consisted of silver iodide and ammonium iodide in acetone. Various aerial pyrotechnic devices were used.



Surface Operations Generator No.	Location	Elevation	Hours of Operation[e] Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total
1	Wishon Dam #1	7,000	0	0	0	0	11.6	4.2	29.4	0	0	0	0	0	45.2
2	Wishon Dam #2	7,000	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Trimmer #1	1.250	0	0	44.6	12.5	0	0	0	0	0	0	0	0	57.1
4	Trimmer #2	1,250	0	0	0	6.5	0	0	0	0	0	0	0	0	6.5
5	Balch Camp #1	1,300	0	11.7	33.2	19.0	11.6	0	38.9	0	0	0	0	0	114.4
6	Balch Camp #2	1,300	0	0	0	0	0	0	10.5	0	0	0	0	0	10.5
7	Hackett Ranch	500	0	10.4	49.0	0	15.2	10.5	0	0	0	0	0	0	85.1
8	Millview	1,900	0	23.5	51.0	38.2	15.5	24.0	0	0	0	0	0	0	152.2
9	Heliport	4,500	0	57.6	51.0	38.3	15.5	0	0	0	0	0	0	0	162.4
10	Sequoia Lake	5,600	0.9	31.3	36.0	38.4	15.7	23.4	0	0	0	0	0	0	145.7
11	Wilsonia	6,030	0	0	0	0	0	32.8	0	0	0	0	0	0	32.8
12	Cherry Gap	6,600	0	41.8	0	38.2	16.2	23.1	0	0	0	0	0	0	119.3
13	Quail Flat	6,900	0	44.2	0	0	0	24.2	0	0	0	0	0	0	68.4
14	Kings Canyon Overlook	7,100	0	0	0	0	15.4	6.7	0	0	0	0	0	0	22.1
15	Pinehurst	4,100	0	34.7	52.1	6.0	0	39.0	0	0	0	0	0	0	131.8
16	Badger	3,000	0	25.7	36.0	21.5	0	16.4	0	0	0	0	0	0	99.6
17	Sierra Glen	3,100	0	1.5	0	0	14.2	10.2	0	0	0	0	0	0	25.9
18	Radar	400	0	32.0	0	0	0	0	0	0	0	0	0	0	32.0
Subtotal, Hours of Surface Operation			0.9	282.4	384.9	218.6	130.9	214.5	78.8	0	0	0	0	0	1,311.0
Hours of Aircraft Operation			1.8	8.4	10.4	1.2	4.0	5.5	6.6	7.1	1.6	6.2	2.9	1.2	56.9
Total Hours, Surface and Air Operations			2.7	290.8	395.3	219.8	134.9	220.0	85.4	7.1	1.6	6.2	2.9	1.2	1,367.9
AgI used, grams, Surface Operations			. . . . . 15 grams per hour per generator[a]												
AgI used, grams, Air Operations[b]			135.0	630.0	780.0	90.0	300.0	438.0	635.0	1,186.0	1,308.8	4,986.4	14,782.4	2,338.2	27,609.8
Total AgI Used			148.5	4,866.0	6,553.5	3,369.0	2,263.5	3,655.5	1,817.0	1,186.0	1,308.8	4,986.4	14,782.4	2,338.2	47,274.8
Number of storms			2	4	4	2	3	3	6	5	3	12	16	2	62
Number of flights			1[c]	7[c]	7[c]	1[c]	3[c]	3[c]	5[c]	5[d]	3[d]	12[d]	16[d]	2[d]	65
Number of days on which seeded			2	8	11	4	4	5	6	5	3	12	16	2	78

a/ Constant rate of dispersal
b/ Rate of dispersal approximately 75 grams per hour of operation, October through March; variable thereafter
c/ Within flight area
d/ Within target area
e/ To nearest tenth of an hour

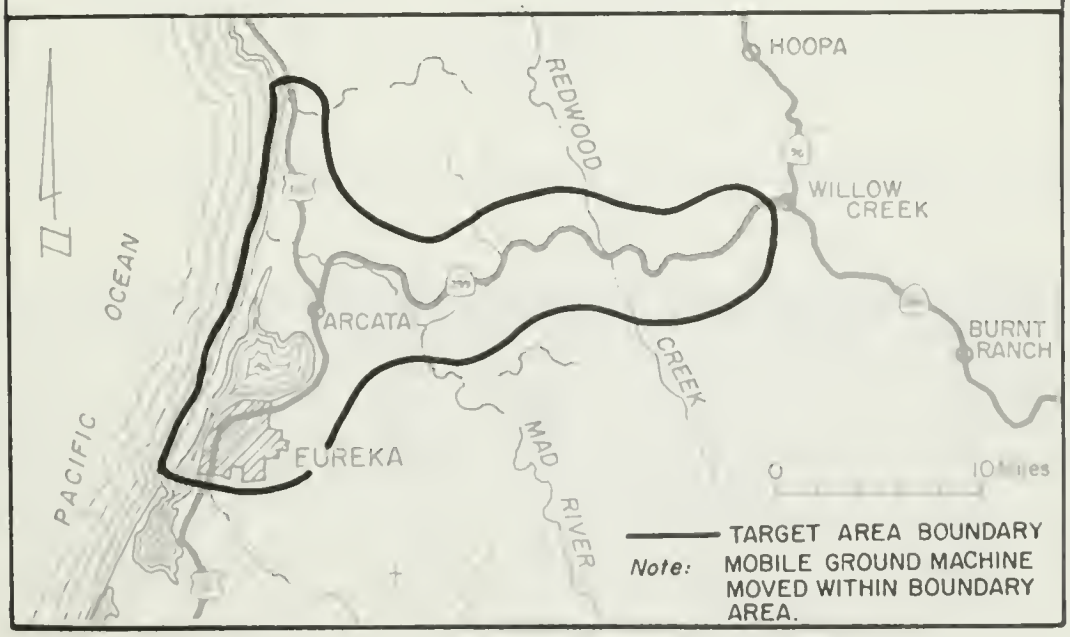
Project 29-71-1: FOG DISPERSAL PROGRAM, ARCATA-EUREKA AREA

SUMMARY

Licensee:	World Weather, Inc.
Client:	Division of Highways, State of California
Target Area:	Highways near Arcata-Eureka and on Arcata Airport
Purpose:	To develop technique to disperse warm fog along highways
Active Agents:	Polyelectrolytes and surfactants
Dispersal Method:	Mobile ground-based generator, with a pressure pump driven by a gasoline engine, that produced a spray of active agents

Generator Location	Hours of Operation**		
	July	August	Total
Highway 299, east of Arcata	1:15	1:37	2:52
Highway 101, between Arcata/Eureka	0	0:30	0:30
Camp 42 Road, east of Arcata	0	4:44**	4:44**
Arcata Airport	2:18	0:26	2:44
TOTAL	3:33	7:17	10:50
Number of days operated	2	6	8
Gallons of active agent	213	305	518
Rate of dispersal, gallons per minute	1		

* To nearest minute.
** Portions of operational periods not seeded totalled two hours and two minutes.



LOCATION OF TARGET AREAS

PLATE

PROJECT NO.	LICENSE NO.	YEAR 1970	YEAR 1971	LICENSEE
1-71-1	1	X	X	North American Weather Consult s Santa Barbara Municipal Airport Goleta, California 93017
1-71-2	1	X	X	North American Weather Consult s
	5	X	X	Water Resources Development Cor Weather Modification Projects 611 South Palm Canyon Drive, S 21 Palm Springs, California 92262
12-71-1	12	X	X	Precipitation Control Company o ti 105 Pierce Street Taft, California 93268
18-71-1	18	X	X	Los Angeles County Flood Contr ls P. O. Box 2418, Terminal Annex Los Angeles, California 90054
21-71-1	21	X	X	Atmospherics, Incorporated 4981 East Dakota Avenue Fresno, California 93727
	22	X	X	San Bernardino Valley Municipal er 1350 South E Street P. O. Box 5906 San Bernardino, California 92408
	23	X	X	Pacific Gas and Electric Company 245 Market Street San Francisco, California 94106
	24	X	X	International Weather Control, Inc or 40 West First Street, Suite 104 Reno, Nevada 89501
	25	X	X	K. R. C. Service Corporation 2956 C Street San Diego, California 92102
	26	X	X	Santa Clara County Flood Control 15420 Almaden Expressway San Jose, California 95118

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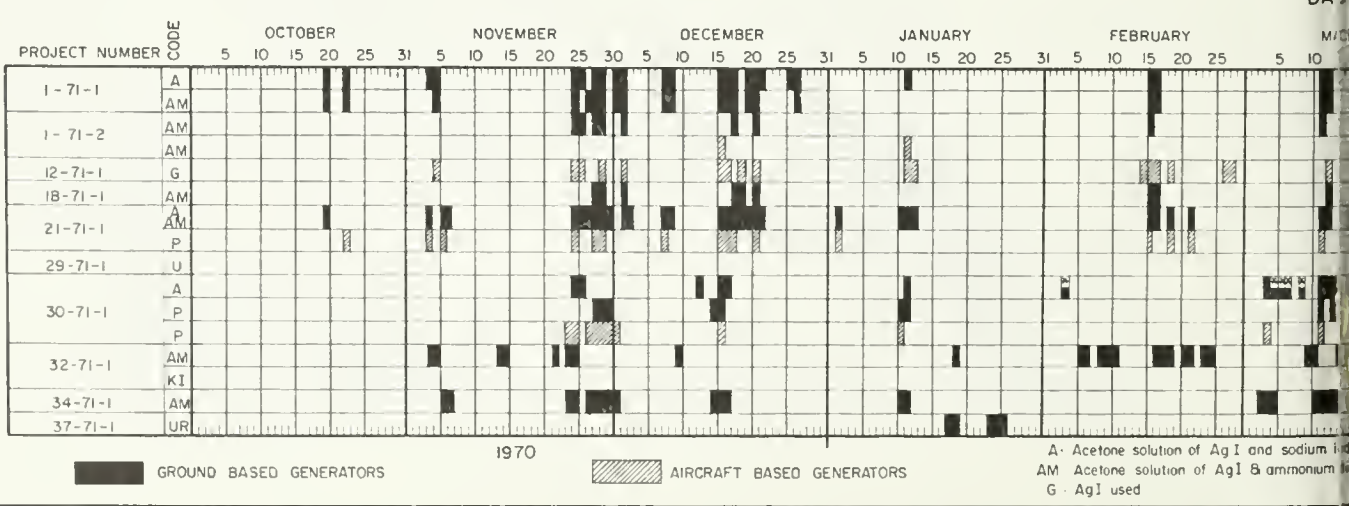

THER MODIFICATION PROJECTS IN CALIFORNIA: 1971 WATER YEAR

CLIENT	PROJECT NO	LICENSE NO	YEAR 1970	YEAR 1971	LICENSEE	CLIENT
Southern California Edison Company		27	X	X	Vista Irrigation District P. O. Box 1088 Vista, California 92083	Licensee inactive this water year
U. S. Naval Weapons Center China Lake		28	X		Weather Science, Incorporated P. O. Box FF Norman, Oklahoma 73069	Licensee inactive this water year
Licensee inactive this water year	29-71-1	29	X	X	World Weather, Incorporated 620 Commercial Bank Tower Midland, Texas 79701	Division of Highways State of California
Kern County Board of Supervisors	30-71-1	30	X	X	Fresno State College Foundation Atmospheric Water Resources Research 4831 East Shields Avenue Fresno, California 93726	Fresno State College Foundation Atmospheric Water Resources Research
Los Angeles County Flood Control District		31	X		Weather Measure Corporation P. O. Box 41257 Sacramento, California 95841	Licensee inactive this water year
Kings River Conservation District	32-71-1	32	X	X	Desert Research Institute University of Nevada System Reno, Nevada 89507	Office of Atmospheric Water Resources U. S. Bureau of Reclamation
Licensee inactive this water year	34-71-1	34	X	X	Sacramento Municipal Utility District P. O. Box 15830 Sacramento, California 95813	Sacramento Municipal Utility District
Licensee inactive this water year		35	X	X	Santiago Engineering, Incorporated 1540 East Edinger Street, Suite E Santa Ana, California 92705	Licensee inactive this water year
Licensee inactive this water year		36	X	X	Wem-Cor, Incorporated 390 Grand Avenue Oakland, California 95610	Licensee inactive this water year
Licensee inactive this water year	37-71-1	37		X	Sierra Research Corporation Environmental Systems Group P. O. Box 3007 Boulder, Colorado 80303	Sacramento Metropolitan Airport
Licensee inactive this water year						

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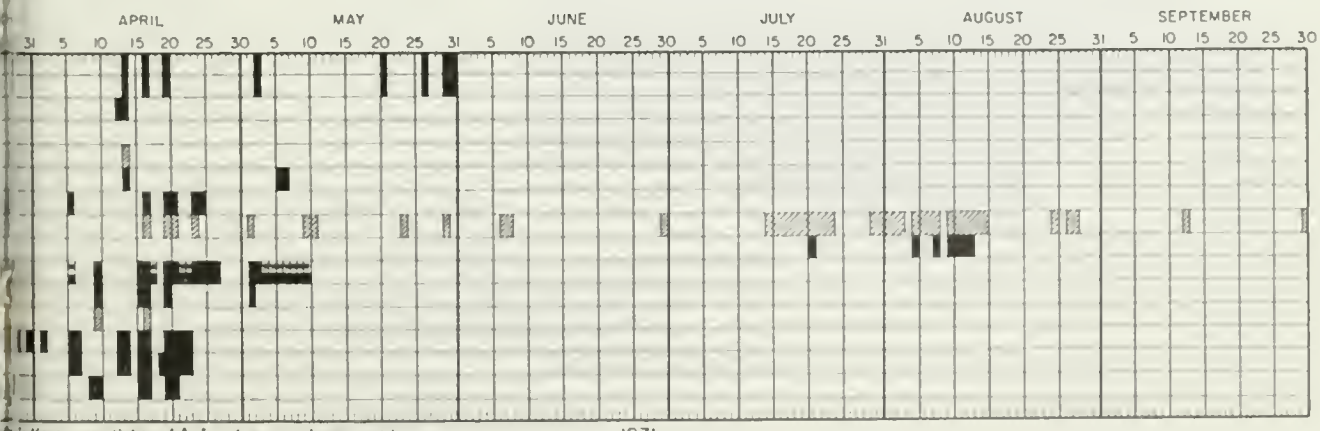


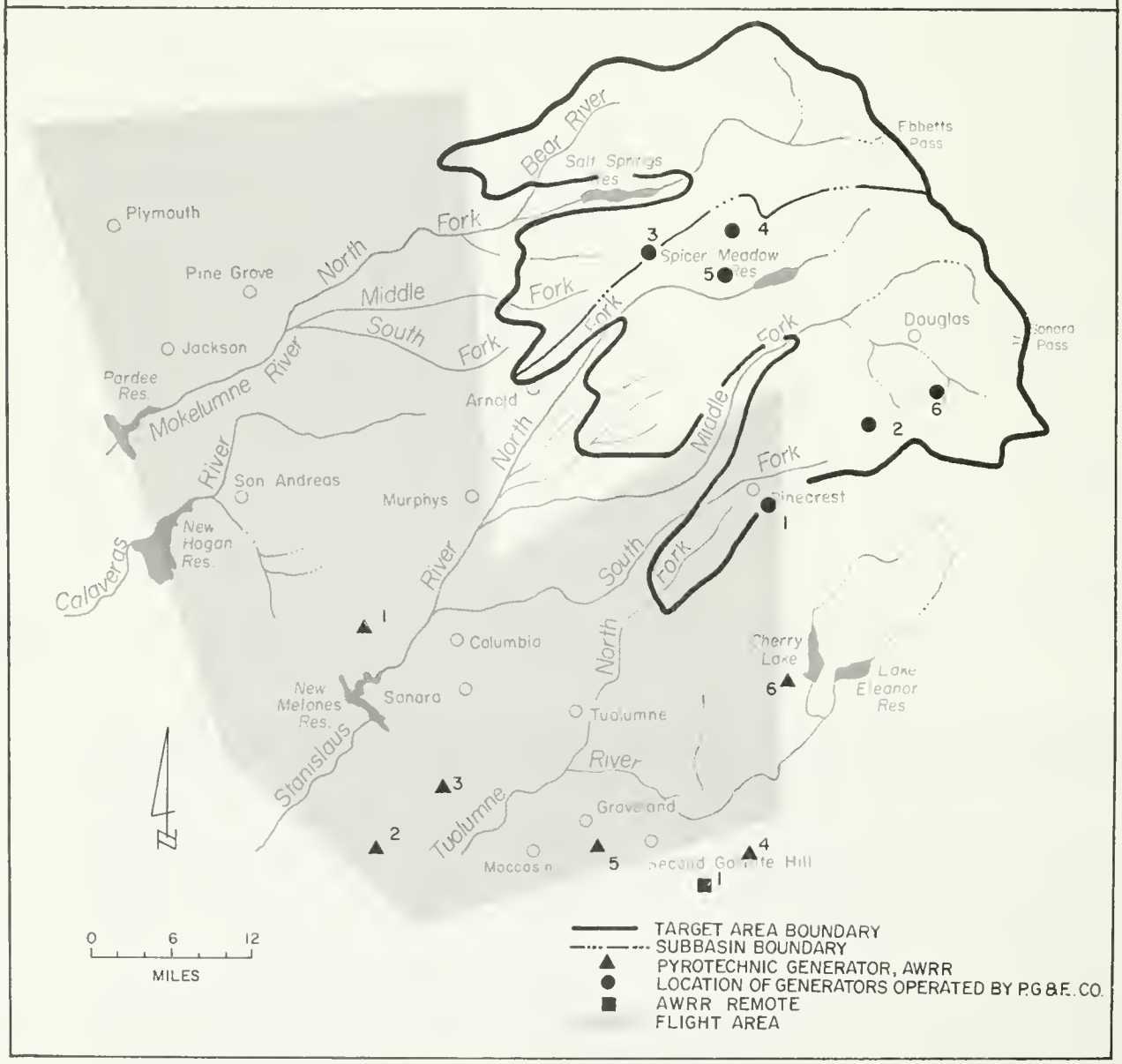
: Kerosene solution of AgI and isopropylamine used
Pyrotechnics used
Polyelectrolytes and surfactants used

UR Urea powder used
Malfunction

Project 30-71-1: CENTRAL SIERRA RESEARCH

SUMMARY

Licensee:	Fresno State College Foundation, Atmospheric Water Resources Research
Client:	Same
Target Area:	Watersheds of the Stanislaus and Mokelumne Rivers above a 5,000-foot elevation
Purpose:	Experimental weather modification for precipitation increase. (Program received continuing financial support of U. S. Bureau of Reclamation and service assistance from various other organizations.)
Active Agent:	Silver Iodide
Dispersal Method:	Various



Generators No.	Generators Location	Elevation	Hours of Operation/ No. of Flares (or No. of Fusees) Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
	P.G.&E., Remote, Acetone Fixed, Ground[a]									
1	Dodge Ridge	7,360	-	4:00	11:30	-	10:55	-	-	26:25
2	Mammil Ridge	8,480	-	22:30	11:30	-	20:10	-	-	54:10
3	Mattley Meadow	7,840	12:30	12:30	-	-	16:25	46:00	-	87:25
4	Mt. Reba	7,680	-	7:45	-	15:00[b]	114:30[b]	53:00[b]	-	190:15
5	Seppa Hill	7,300	12:30	30:15	6:00	-	19:30	53:00	10:30	131:45
6	Bennet-Juniper	8,320	-	-	-	-	-	126:00[b]	183:15[b]	309:15
	Subtotal		25:00	77:00	29:00	15:00	181:30	278:00	193:45	799:15
	P.G.&E., Remote, Pyrotechnic (20-gm flares) Fixed, Ground[c]									
1	Dodge Ridge	7,360	-	-	-	-	5:30/8[d]	3:00/1[d]	-	8:30/9
2	Mammil Ridge	8,480	-	-	-	-	5:30/7[d]	3:00/1[d]	-	8:30/8
3	Mattley Meadow	7,840	-	-	-	-	5:30/1[d]	-	-	5:30/1
4	Mt. Reba	7,680	-	-	-	-	-	-	-	-
5	Seppa Hill	7,300	-	-	-	-	-	3:00/7[d]	-	3:00/7
6	Bennet-Juniper	8,320	-	-	-	-	-	-	-	-
	Subtotal		-	-	-	-	16:30/16	9:00/9	-	25:30/25
	AWRR, Remote, Pyrotechnic (30-gm flares) Fixed, Ground									
1	Smith Peak L.O.	3,870	-	-	-	-	2:30/8	-	-	2:30/8
	Subtotal		-	-	-	-	2:30/8	-	-	2:30/8
	AWRR, Manual, Pyrotechnic (20-gm flares) Fixed, Ground									
1	Angels Camp	1,530	-	5:45/47	3:00/19	-	9:00/64	-	-	17:45/130
2	Sonora 11 SSW	1,260	-	1:00/8	-	-	-	2:00/16	-	3:00/24
3	Chinese Camp	1,300	6:00/43	-	-	-	7:15/55	1:30/13	-	14:45/111
4	Bucks Meadow	3,010	12:05/66	-	-	-	2:00/14	3:00/9	-	17:05/89
5	Groveland	3,200	8:00/46	2:15/15	3:30/17	-	8:00/55	7:45/54	-	29:30/187
6	Cherry Lake (40gm flares)	4,710	-	-	-	-	3:00/20	-	3:00/21	6:00/41
	Subtotal		26:05/155	9:00/70	6:30/36	-	29:15/208	14:15/92	3:00/21	88:05/582
	Aircraft (fusees)[e]		5:29/100	3:47/37	1:21/31	-	12:24/182	2:18/37	-	25:19/387
	TOTAL HOURS SURFACE AND AIR OPERATIONS		56:34	89:47	36:51	15:00	242:09	303:33	196:45	940:39

a/ Six generators supplied and operated by the Pacific Gas and Electric Company under the direction of the Fresno State College Foundation burned a solution of silver iodide and sodium iodide (in acetone).
b/ Excess burn because of generator malfunction.
c/ Six remote pyrotechnic generators located at the sites of the acetone generators operated through the Pacific Gas and Electric Company.
d/ Deficient burn because of generator malfunction.
e/ Aircraft followed a variable flight pattern within the flight area.

Generator	Burn rate per generator, in grams of silver iodide per hour	Burn time, in seconds	Silver iodide, in grams produced per unit	Nuclei produced per gram of silver iodide	Elapsed interval between pyrotechnic burns
Acetone	30	–	–	2×10^{13} at -12°C	–
Pyrotechnic 20-gram flares	–	45	20	1×10^{13} at -12°C	manual: 8 min. (approx); remote: variable
30-gram flares	–	900	30	5×10^{11} at -7°C . 6×10^{14} at -17.5 C	5 min. (approx)
40-gram flares (2 20-gram flares burned 2 min. apart)	–	210	40	1×10^{13} at -12°C	8 min. (approx)
Fusees, aircraft	–	150	40	1.25×10^{14} at -12°C	variable

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Total
Number of flares, 20-gram	155	70	36	0	204	101	0	566
30-gram	0	0	0	0	8	0	0	8
40-gram	0	0	0	0	20	0	21	41
Number of fusees	100	37	31	0	182	37	0	387
AgI used (grams)	7,850	5,190	2,830	450	22,359	13,100	6,652	58,431
Number of storms seeded	3	2	1	0	5	4	1	16
Days on which seeded	7	5	2	1	13	13	9	50
Days on which seeded (excluding days of generator malfunction alone)	7	5	2	0	7	9	2	32

Project 32-71-1: LAKE TAHOE AND TRUCKEE RIVER BASIN

SUMMARY

Licensee: Desert Research Institute

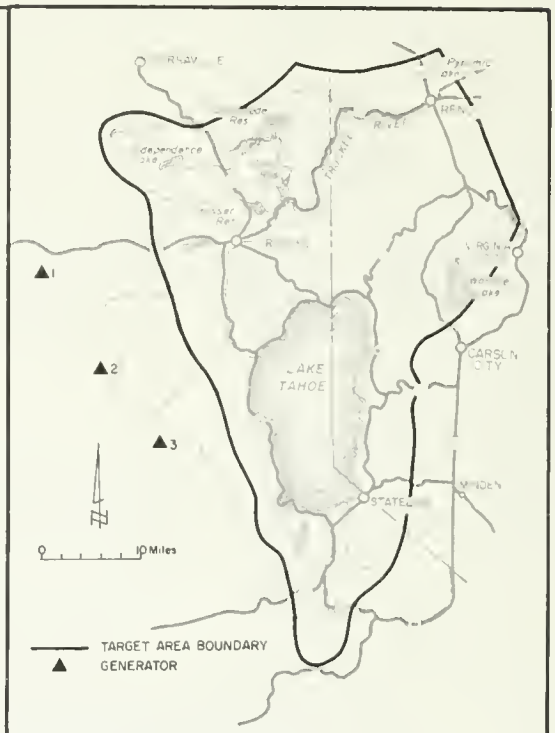
Client: Office of Atmospheric Water Re-Sources, U. S. Bureau of Reclamation

Target Area: Lake Tahoe and Truckee River watersheds

Purpose: Research to increase inflow to Pyramid Lake

Active Agent: Silver iodide

Dispersal Method: Ground-based generators: generator No. 1, a USBR II model, burned a solution of silver iodide and isopropylamine (in kerosene); generators No. 2 and 3, North American Weather Consultant models, burned a solution of silver iodide and ammonium iodide (in acetone)



Generator			Hours of Operation						
No.	Location	Elevation	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
1	Cisco Butte	6,400	-	-	-	-	-	98:10	98:10
2	Duncan Peak	7,182	5:05	1:00	2:00	53:40	21:40	106:00	189:25
3	Bunker Hill	7,524	1:50	1:00	3:00	78:20	70:50	0	155:00
	TOTAL		6:55	2:00	5:00	132:00	92:30	204:10	442:35
Number of storms			7	6	3	5	4	6	31
Days of seeding			7	1	1	12	10	12	43
AgI used, grams			69.2	20	50	1,320	925	4,594	6,978.2

Rate of dispersal (grams per hour per generator)

Generator No. 1	Generator No. 2	Generator No. 3
36	10	10

Project 34-71-1: UPPER AMERICAN RIVER

SUMMARY

Licensee:[a]	Sacramento Municipal Utility District
Client	Same
Target Area:	Upper American River Basin, eastern El Dorado County, north of U. S. 50
Purpose	To increase snowpack for water supply
Active Agent:	Silver iodide
Dispersal Method:	Ground-based generators[b] burning a solution of silver iodide and ammonium iodide (in acetone)

a/ Change in licensee from 1969-70 season
b/ Several changes in generator location from 1969-70 season

Generator			Hours of Operation*						
No.	Location	Elevation	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
1	Big Hill	6,125	66:30	53:00	27:00	-	78:45	21:30	246:45
2	Robbs Saddle	5,725	78:40	58:00	28:30	-	148:05	42:20	355:35
3	West Peavine	5,020	41:00	44:40	5:00	-	138:40	35:25	264:45
4	Logdeck	5,225	77:50	56:30	30:05	-	143:50	58:00	366:15
5	Kyburz	3,975	51:00	55:50	30:50	-	141:30	64:10	343:20
6	Fresh Pond	4,100	52:40	54:55	27:45	-	137:45	56:05	329:10
TOTAL			367:40	322:55	149:10	-	788:35	277:30	1,905:50
Number of storms			4**	7	1	3	7	4	26
Days on which seeded			8	4	2	0	13	6	33
AgI used, grams			9,191	8,073	3,729	0	19,715	6,938	47,646
Rate of dispersal (grams per hour per generator)			25						

* To nearest five minutes.
** Storm on last of November carried into December 1. This storm was included in November and not in December.

Project 37-71-1: FOG DISPOSAL PROGRAM, SACRAMENTO METROPOLITAN AIRPORT

SUMMARY

Licensee:	Sierra Research Corporation
Client:	Sacramento Metropolitan Airport
Purpose:	To obtain technical and engineering data in support of airport warm fog dispersal operations using ground-based generators
Active Agent:	Urea
Dispersal Method:	Ground-based generators which force a vertical stream of air and urea powder (fertilizer grade) to altitudes of 200 feet above ground level

	Date					Totals
	1/18/71	1/19/71	1/24/71	1/25/71	1/26/71	
Minutes of operation	53	58	33	76	58	278
Rate of dispersal, pounds per minute	10-25	14 (approx.)	45-50	10-25	20-50	-
Total pounds of urea	800	800	1,500	1,400	1,500	6,000

WEATHER MODIFICATION INVESTIGATIONS BY THE ARMED FORCES IN CALIFORNIA

In recent years, the U. S. Air Force has conducted an investigation of warm fog suppression techniques. Its purpose was to provide the quantitative data on hygroscopic treatment needed to lead to development of a model and only occasional field studies.

In the past decade the U. S. Naval Weapons Center, China Lake, has carried out several warm fog suppression investigations near Arcata, California, the latest during the summer of 1971. Details of these studies have not as yet been received.

Locations of Air Force warm air studies are shown on Plate 3 on the following page.

AIR FORCE WARM FOG SUPPRESSION STUDIES

Year	Period within which Operated	Location	Material or Method	Number of of Days Operated	Number of Runs	Rate of Dispersal per Run	Total Material Released, in pounds
1959	–	Arcata	–	–	–	–	–
1968	Oct. 8-9	Near Santa Maria	Sodium Chloride (powder) (NaCl)	2	4 2 (over water)	500 lbs	2,000
1968	Oct. 28 Nov. 11	Near Santa Rosa	NaCl (powder)	5	6 1	550 lbs 350 lbs	3,650
1968	Dec. 9-20	Near Columbia	NaCl (powder)	1	2	550 lbs	1,100
1969	Apr. 26-May 8	Near Lakeport	NaCl (powder)	9	25	Variable	11,000
			Sodium Nitrate (powder) ($NaNO_3$)		9	Variable	4,125
1969	Oct. 9-26	Noyo River Valley (six miles west of Willits)	NaCl (powder)	7	17	Variable	10,550
			Polyelectrolyte		1	250 lbs	250
1971	Jan. 19-Feb. 3	McClellan A.F.B.	Urea (powder)	6	5	Unknown	Unknown
			Helicopter downwash		4	None	None

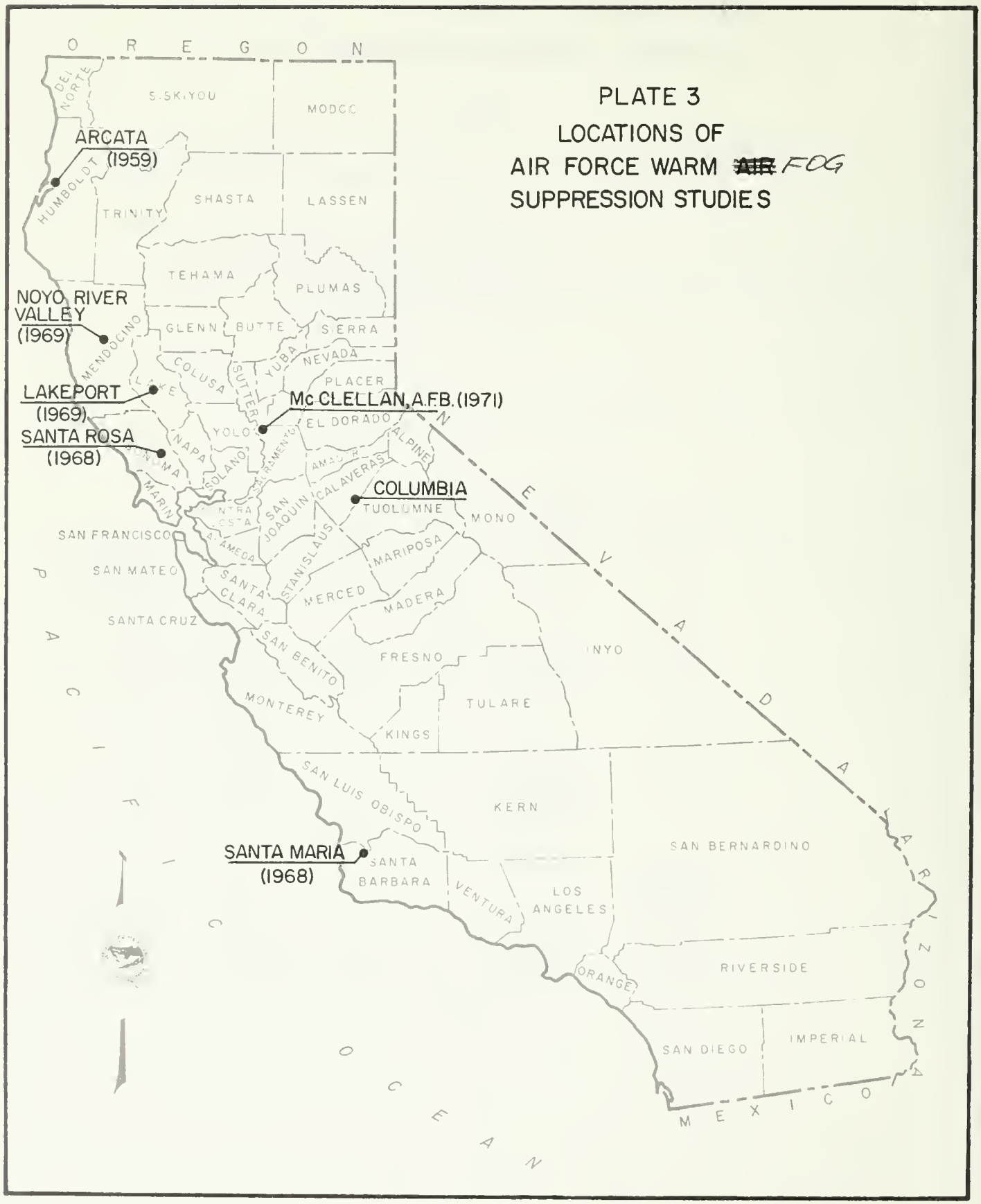


PLATE 3
LOCATIONS OF
AIR FORCE WARM ~~AIR~~ FOG
SUPPRESSION STUDIES
ARCATA
(1959)
NOYO RIVER
VALLEY
(1969)
LAKEPORT
(1969)
SANTA ROSA
(1968)
Mc CLELLAN, A.F.B. (1971)
COLUMBIA
SANTA MARIA
(1968)
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
DEL NORTE
S. SKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
GLENN
BUTTE
SIERRA
MENDOCINO
COLUSA
YUBA
NEVADA
SUTTER
PLACER
LAKE
YOLO
EL DORADO
NAPA
SOLANO
SACRAMENTO
AMADOR
ALPINE
SONOMA
CALAVERAS
MARIN
CONTRA COSTA
SAN JOAQUIN
TUOLUMNE
MONO
SAN FRANCISCO
ALAMEDA
STANISLAUS
MARIPOSA
SAN MATEO
SANTA CLARA
MERCED
MADERA
SANTA CRUZ
SAN BENITO
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